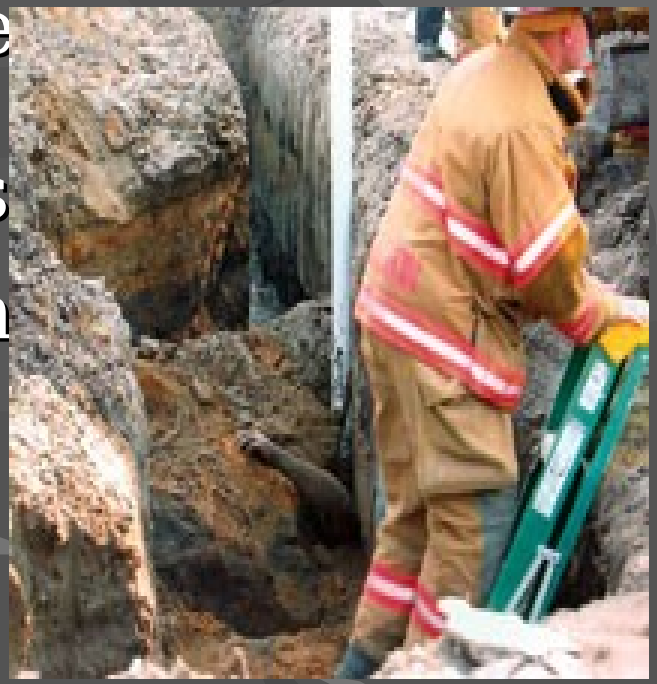
EXCAVATIONS

EM 385-1-1, Section 25

DIN 4123

Injury and Death

- Excavating is one of the most hazardous construction operations
- Most accidents occur in trenches 1.5 to 4.5 m deep
- There is usually no warning before a cave-in



Injury and Death

- Most victims suffer from mechanical asphyxia.
- The weight of the dirt, about 1,360 kg (3,000 lb) per cu yd, compresses the chest.
- This prevents victims' rib cages from expanding for breathing. Suffocation within 3 minutes

Excavation Planning:

- All excavations should be addressed in an Activity Hazard Analysis
- Underground utilities must be located and protected from damage
- Exposure to hazardous materials

Excavation Planning:

- Potential for UXO
- Vibration
- Depth/weight
- Soil Composition
- Water
- Previously Excavated Area

Inspection and Testing:

- When personnel are working in or around excavations, inspections by a competent person should be made daily, as needed throughout the work shift, and after every hazard-increasing occurrence, such as rainstorms.

What to Look for:

- Bulging sidewalls
- Surface fractures near top
- Loose material on sides or floor of excavation
- Water
- Accumulation of material at the top of the excavation

Equipment and Vibrator Hazards

Protective Systems:

- The sides of all excavations will be protected by support systems, sloping or benching whenever personnel are exposed to danger of moving ground. Unless:
- Excavation is less than 1.25 m in depth, and,
- Determined safe by competent person

Protective Systems:

Adjacent Structures:

- Excavations not to go below footing of adjacent structure unless structure is underpinned, or determined safe by RPE
- Sidewalks and pavement not to be undermined unless properly supported
- Any undercut material in an excavation must be safely supported

Adjacent Structures:

Adjacent Str

Protection from Water:

- Diversion ditches or dikes to protect excavations from surface water accumulation
- Personnel not to work in excavations with accumulated water unless hazards are controlled
- Ground water control equipment

Protection from Falling Material:

- Employees to be protected from falling loose rock or soil:
- Scaling
- Benching
- Rock bolting
- Wire mesh
- Barricading

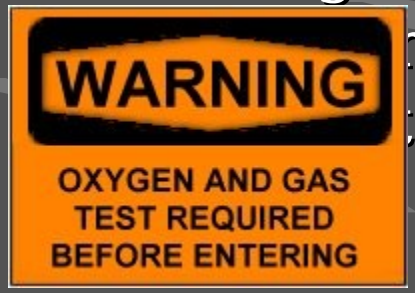
Spoils

- Don’t place spoils within 0.6 m (2’) from edge of excavation
- Place spoils so rainwater runs away from the excavation

Hazardous Atmosphere

If known or suspected, test excavations for:

- Oxygen deficiency
- High combustible gas concentration
- High levels of other



Perimeter Protection:

- Perimeter protection will be provided to protect people and equipment from falling to excavations

Class I Perimeter Protection:

- Required when excavation is exposed to member of public, vehicles, or equipment
- Must meet strength, height and deflection requirement of guardrails

Class I Perimeter Protection:

- If the perimeter protection is for the purpose of protecting vehicles or equipment from falling into the excavation, it must be designed to withstand the potential forces from impact by traffic

Class I Perimeter Protection:

Protection from Vehicles

- Install barricades
- Stop logs
- Fence or barricade trenches left overnight

Safe Access:

Safe Access:

- Excavations to be backfilled as soon as possible

Means of Egress

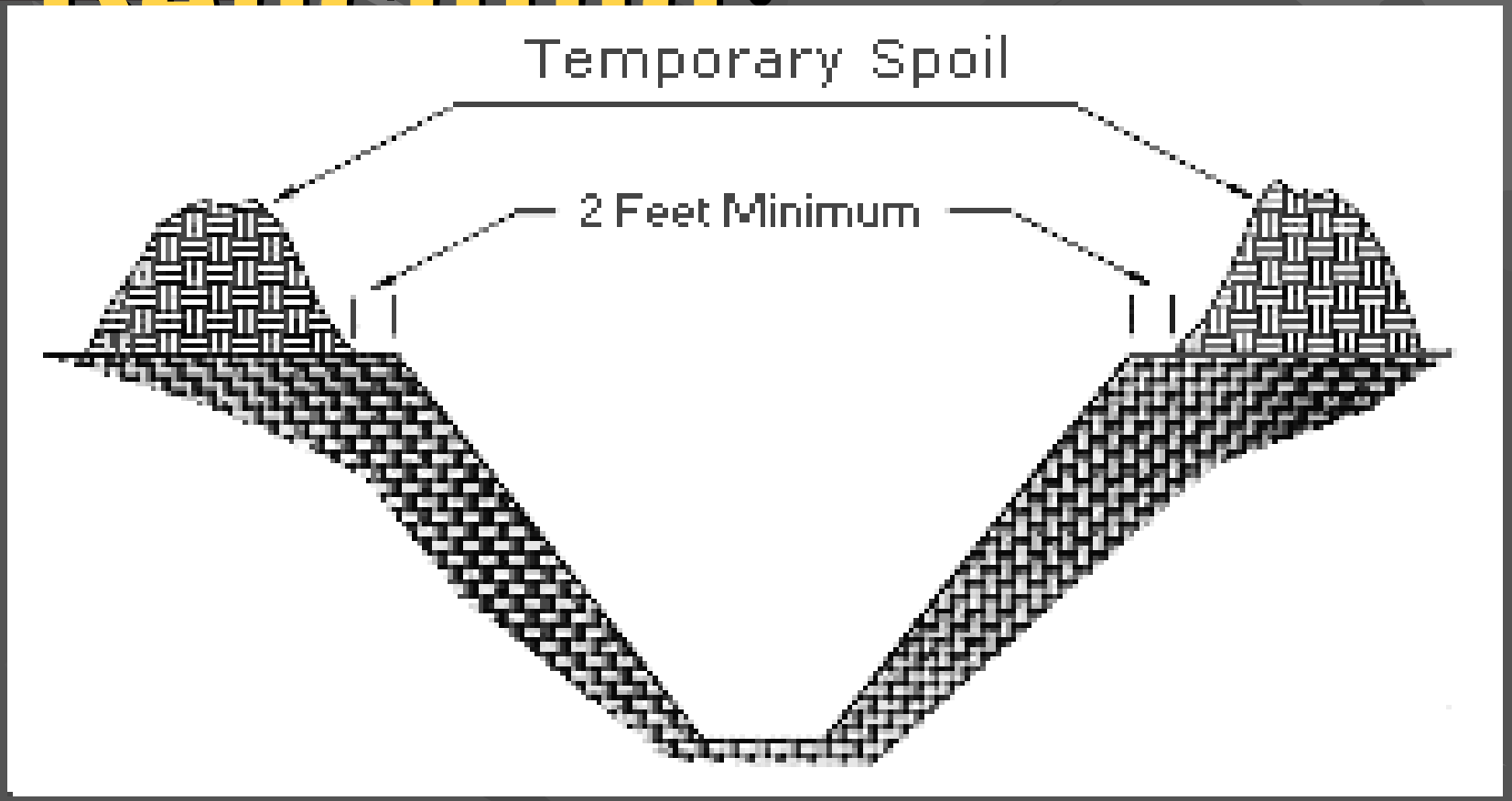
A stairway, ladder, or ramp must be present in excavations that are 1.2 m (4’) or more deep, and within 7.6 m (25’) of the employees

The ladder should extend 3 feet above the excavation

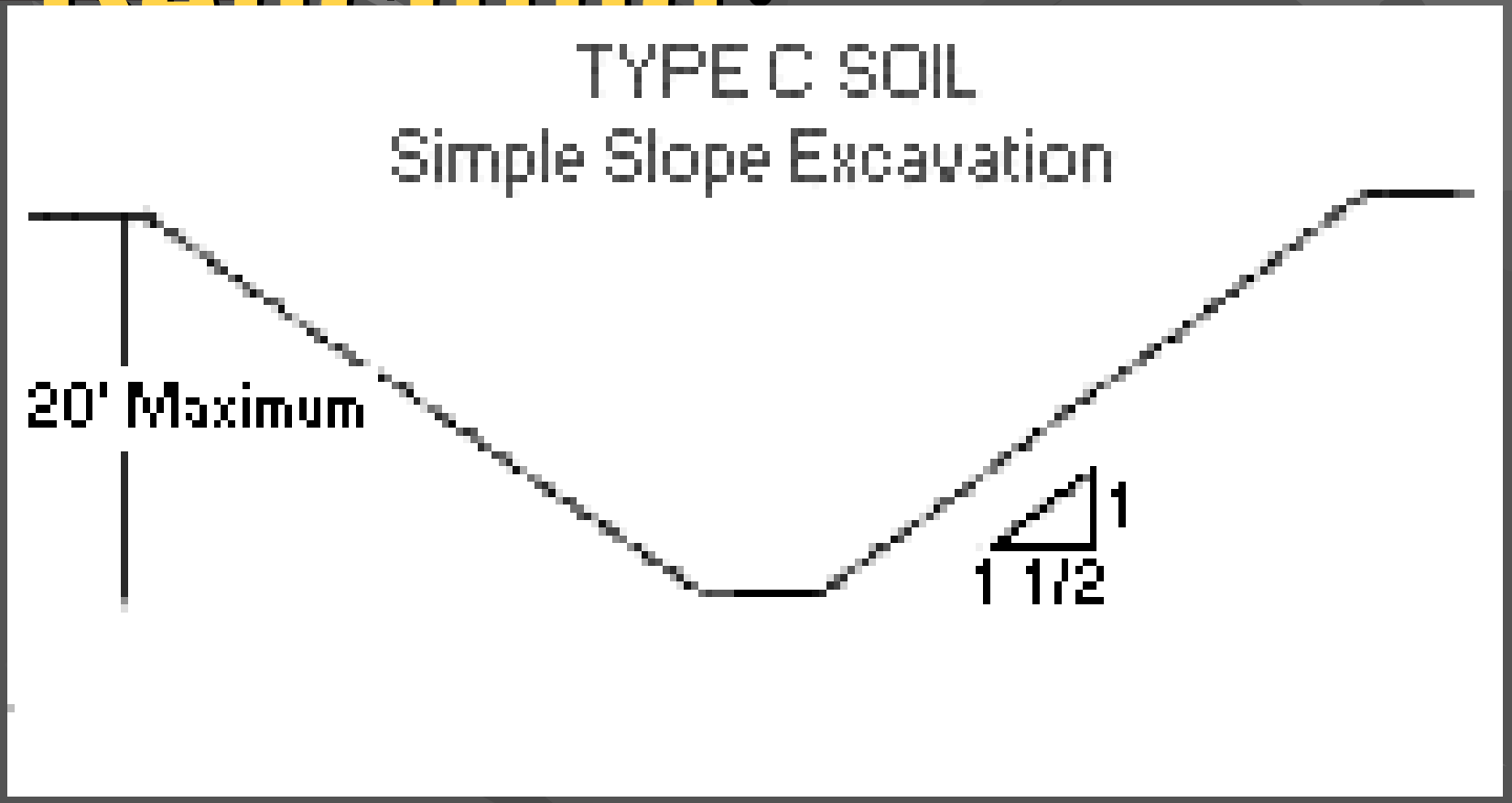
Sloping and Benching:

- Maximum slope to be 34 degrees measured from horizontal (1-1/2 horizontal to 1 vertical)
- Only applicable to excavations less than 6 m (20’) deep

Sloping and Benching:



Sloping and Benching:



Sloping and B

Support Systems:

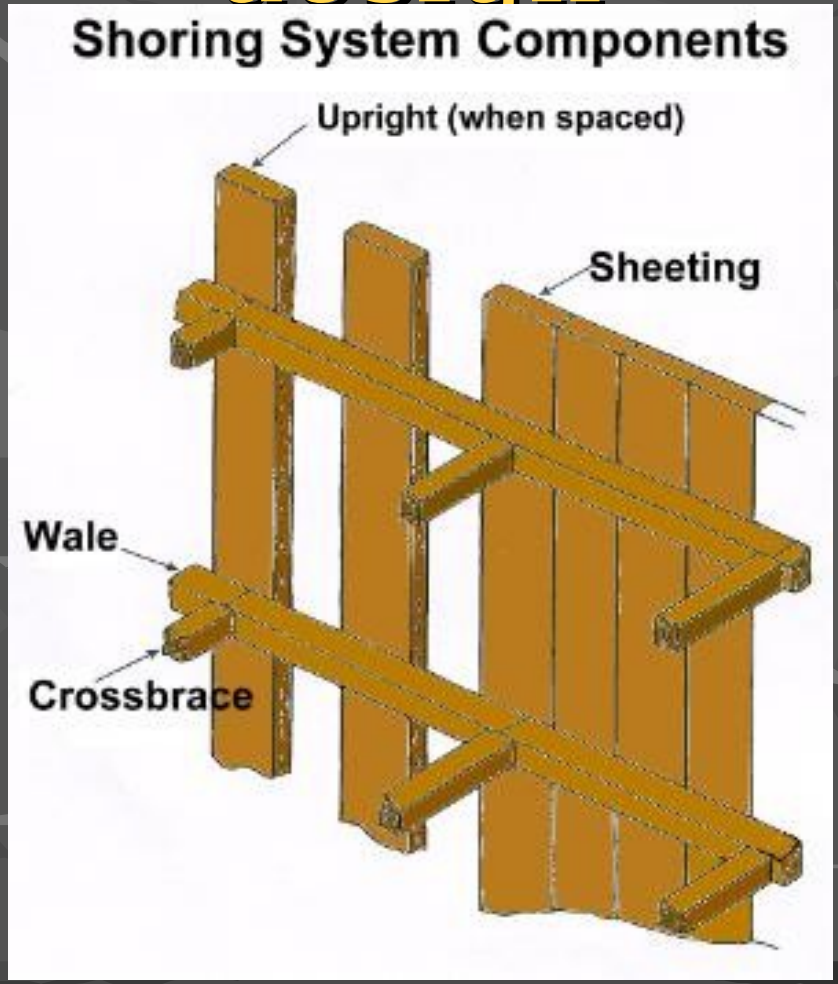
Support Systems:

- Must be used in accordance with manufacturer's specifications and recommendations, or:
- In accordance with tabulated data, or;
- Designed by a RPE

Support Systems:

- Equipment and material must be free from damage or defects
- All members to be securely connected
- Installed and removed so as to protect workers
- Backfilling to progress with removal of support systems

An Engineer needs to design

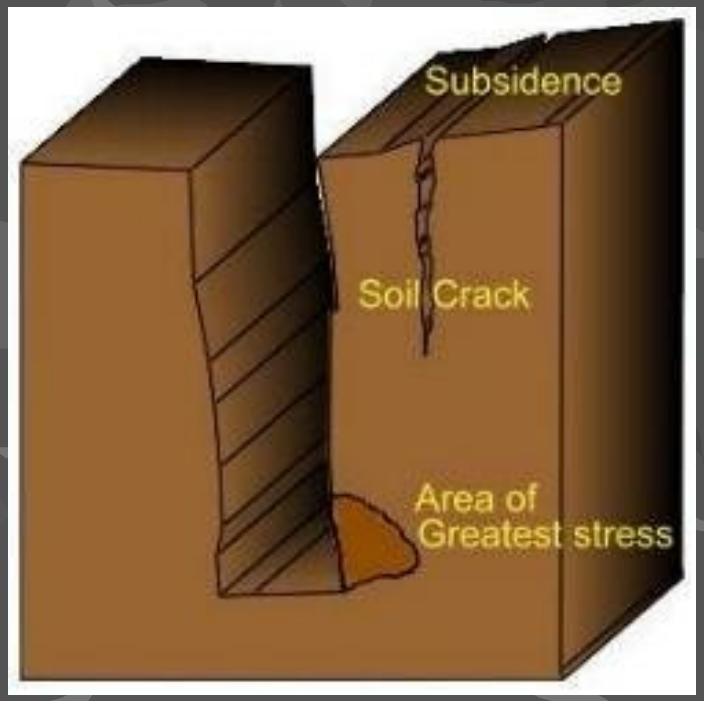


Cave-in Hazard

Inadequate protective system

This excavation has inadequate support posts and egress access

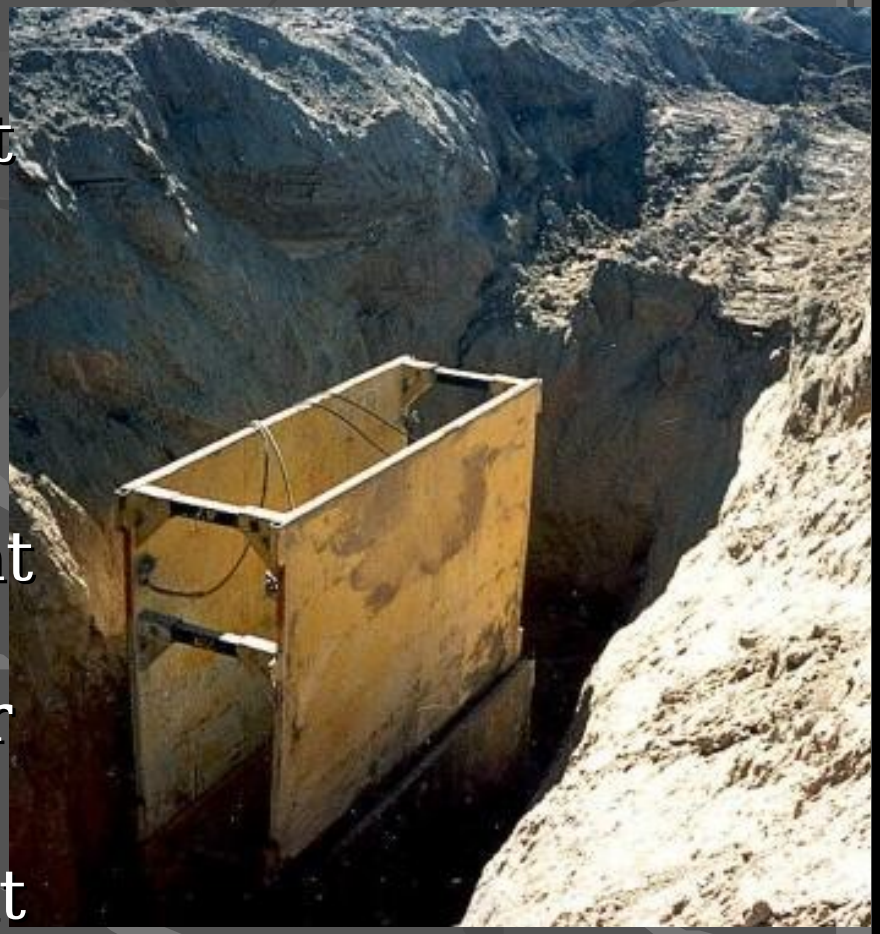
Mechanics of a trench collapse



Shield Systems:

Materials and Equipment

- Equipment used for protective systems must not have damage or defects that impair function.
- If equipment is damaged, the competent person must examine it to see if it is suitable for continued use.
- If not suitable, remove it from service.



Questions?